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PRELIMINARY ESTIMATES OF HUMAN-INDUCED INJURY TO AND MORTALITY OF CETACEANS IN ATLANTIC CANADA

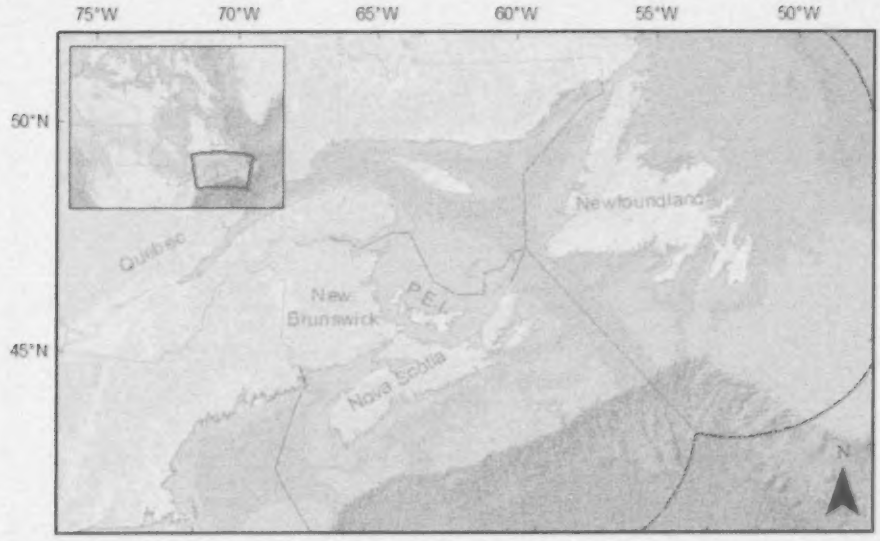

Figure 1. Map of Atlantic Canada. The four DFO regions are outlined in blue: Quebec, Gulf (Eastern and Northern New Brunswick, Northern Nova Scotia and PEI), Maritimes (Western and Southern New Brunswick and Eastern, Western, and Southern Nova Scotia), and Newfoundland and Labrador (map created by Mike McMahon).

Context:

Information on human-induced injuries to cetaceans occurring in Atlantic Canada is required to evaluate the impacts of human activities on cetacean populations, the effectiveness of recovery strategies for species at risk, and to support management decisions on mitigation measures for cetacean interactions with commercial fisheries. The recovery strategies for all Atlantic Canadian whale species listed under the Species at Risk Act identify entanglement with fishing gear as a threat to recovery. Baseline information and methods to evaluate the effectiveness of current and future mitigation measures do not exist. The implementation of the United States (U.S.) Marine Mammal Protection Act by the U.S. will require Canadian fisheries to have effective measures to protect marine mammals, equivalent to the marine mammal protection standards required of U.S. fisheries, or be denied import privileges. Since 1972, the U.S. Marine Mammal Protection Act has prohibited the United States from allowing seafood to enter the country unless it meets U.S. whale and dolphin standards. Under a 2015 settlement, the U.S. Federal government must make a final decision by August 2016 about how to implement this requirement and end unlawful imports. To be able to demonstrate that Canada is meeting U.S. requirements, there is a need to evaluate how much serious harm and mortality to cetaceans is due to interactions with Canadian-licensed fisheries operating in Atlantic Canadian waters.

This Science Advisory Report is from the October 20-23, 2015, Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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SUMMARY

- Sources of information on human-induced injury and mortality to cetaceans include at-sea observations of the commercial fisheries that incidentally catch marine animals recorded in Fisheries and Oceans Canada (DFO) databases and strandings and entanglements recorded by marine mammal response networks and disentanglement teams (i.e., opportunistic data).
- Marine mammal response networks provide opportunistic data that are useful for examining causes and sources of human-induced injury and mortality, particularly of some larger cetaceans, but these data cannot be used to estimate the total fishery-specific bycatch.
- Based on the current, but incomplete response network information, the cause of more than 50% of all reported cetacean mortalities could not be identified. Detailed study of carcasses could improve assessment of human-induced injuries.
- Effort-based data (such as at-sea fisheries observer data) is required to calculate fisheries-specific bycatch rates of cetaceans and estimates of uncertainty. However, observer coverage of commercial fisheries is low for many fisheries known to incidentally catch cetaceans (i.e. snow crab and lobster pot/trap, groundfish fixed gillnet and longline and mobile gear).
- Existing data are insufficient or outdated to estimate fishery-specific rates of human-induced mortality and injury to cetaceans in Atlantic Canada, and to convert these rates to total bycatch. Estimates of fishery-specific bycatch for most cetacean species will benefit from enhanced at-sea observer coverage.
- Estimates of current abundance are unavailable for most cetacean species occurring in Atlantic Canadian waters. This is a knowledge gap that will need to be addressed before evaluating the impacts of human-induced mortality on populations.
- Opportunistic data from response networks indicate that the magnitude of human-induced injury and mortality of North Atlantic Right Whale exceeds the potential biological removal calculated for the population occurring in the northwest Atlantic.
- The DFO Marine Mammal Response Program (MMRP) receives opportunistic data on cetacean strandings and entanglements from all DFO regions. These data would be more valuable for determining causes and sources of cetacean injury and mortality if reporting protocols among regions were standardized.
- Effort-based data collection on human-induced cetacean injury and mortality should be standardized nationally and made available for analysis.

BACKGROUND

Information on human-induced injuries to cetaceans occurring in Atlantic Canada is required to evaluate the effectiveness of recovery strategies for species at risk and to support management decisions on measures to mitigate entanglement risk from commercial fisheries. Cetaceans reported stranded or entangled in fishing gear in Canadian waters include mysticete (baleen) and odontocete (toothed whales, dolphins and Harbour Porpoise) (Hooker et al. 1997, Reeves et al. 2013). An objective of all recovery strategies published for Atlantic Canadian cetaceans protected under the *Species at Risk Act* [North Atlantic Right Whale (DFO 2014), Scotian Shelf population of Northern Bottlenose Whale (DFO 2010), Atlantic Blue Whale (Beauchamp et al. 2009) and the St Lawrence estuary population of Beluga Whale (DFO 2012)], is the reduction of mortality and injury due to interactions with fishing gear.

A second incentive for estimating species-specific human-induced mortality is the implementation of the U.S. *Marine Mammal Protection Act* (MMPA) and its impact on Canadian fisheries that export seafood into U.S. markets. The MMPA requires the U.S. Federal government to estimate annual levels of human-induced serious injury and mortality to marine mammal stocks and to categorize foreign commercial fisheries based on their level of incidental serious injury to and mortality of marine mammals. In preparation for this ruling, preliminary estimates of human-induced injury and mortality were assessed for cetaceans occurring in Atlantic Canada.

Data Sources

Reported incidents of human-induced injury and mortality to cetaceans in Atlantic Canada from 2008-2014 were compiled from two types of data sources. The first were opportunistic sightings of marine mammal strandings and human interactions reported to marine mammal response networks. There are several marine mammal response networks that operate throughout Atlantic Canada. These networks collect information on the species, type of incident, location and causes of injury, and provide annual reports to the Fisheries and Oceans Canada (DFO) National Marine Mammal Response Program (MMRP). The quality and detail of these data vary considerably by year due to differing data collection and reporting protocols between networks, and the gradual development and expansion of the MMRP since its inception in 2008. Human-induced injuries in Atlantic Canada to large baleen whales that are considered transboundary stocks are also collected and published by the U.S. Federal government National Marine Fisheries Service (NMFS).

Each incident record was evaluated for cause of injury or mortality. Animals reported alive were only designated seriously injured if the incident was confirmed by the NMFS, which has an established protocol for assessing injury (Henry et al. 2015), or if a disentanglement team reported that the animal was severely entangled and could not be disentangled.

The second source of data is the At-sea Observer programs. At-sea fishery observers record incidental catches of cetaceans during fishing operations. These data are not recorded by the MMRP. The observer data can be used to estimate fishery-specific cetacean bycatch rates and estimates of uncertainty. Four DFO regions share responsibility for managing Canada's Atlantic Ocean resources: Quebec, Gulf, Maritimes and Newfoundland and Labrador (Fig. 1). Each DFO region maintains its own fishery observer program. At-sea observations of interactions between cetaceans and fishing gear were available only from Maritimes and Quebec regions.

ANALYSIS

Almost 800 incidents involving 19 cetacean species were reported by marine mammal response networks in Atlantic Canada from 2008-2014 (Table 1). Incidents involving mysticetes (North Atlantic Right, Humpback, Minke, Fin, Sei, Blue and Bowhead Whales) were most commonly reported, followed by small odontocetes (Pygmy Sperm Whale, White-sided, Common, Risso, Striped and White-Beaked Dolphins and Harbour Porpoise) and large odontocetes (Beluga, Northern Bottlenose, Sowerby's Beaked, Sperm and Pilot Whales). The species most likely to be reported entangled in fishing gear were North Atlantic Right Whale (95% of incidents) and Humpback Whale (85% of incidents). Other mysticetes, and both large and small odontocetes, were most likely to be reported as floating or beached carcasses or in stranding events (55-95% of reports). With the exception of North Atlantic Right Whale, the cause of death in more than 60% of all observed cetacean mortalities was unknown. Observations of injury attributed to collisions with vessels were very low, involving a total of seven animals.

Table 1. Numbers of incidents, percentage type of incidents, and proportion of cetacean carcasses reported with unknown causes of death recorded by marine mammal response networks in Atlantic Canada from 2008-2014.

Species	Number Incidents	Percent of Reported Incidents			
		Fishing Gear	Collision	Strandings or Carcasses	Reported Dead and Cause of Death Not Known
North Atlantic Right Whale	19	95	5	0	0
Humpback Whale	113	85	0	15	94
Other mysticetes	228	32	2	66	82
Large odontocetes	168	4	0	96	84
Small odontocetes	353	24	<1	75	74

Gear type could not be identified in 78% of interactions between North Atlantic Right Whale and fishing gear reported by response networks. Further, gear type could not be identified in about half (43-49%) of all fishing gear interactions with other baleen whales reported by response networks (Table 2). Gear types that could be identified in some incidents were pot (snow crab or lobster trap), fixed traps (capelin, cod, mackerel, weir), and nets (seine, gillnet). Entanglements in fishing gear by large odontocetes were infrequently reported by response networks. Most of the small odontocetes were Harbour Porpoise observed in fixed traps (weirs) and released without injuries.

The North Atlantic Right Whale annual mortality rate attributed to fishing gear interactions was 0.43 animals per year (Table 2). The annual injury rate due to fishing gear interactions was 1.57 animals per year (Table 2). The annual mortality and injury rates due to fishing gear interactions for Humpback Whale were 2.57 and 6.43 animals per year, respectively (Table 2).

Table 2. Number of fishing interactions and percentage by gear type recorded by marine mammal response networks in Atlantic Canada from 2008-2014. Annual rate of mortality (numbers of dead animals reported entangled in fishing gear) and injury (injured and dead animals entangled in fishing gear) averaged over the seven years. A dash (-) indicates insufficient data.

Species	Number Incidents	Percent Associated with Gear Type				Average Annual Rate (Animals per Year)	
		Pot / Trap	Fixed Trap	Net	Unknown (Rope, Buoys)	Mortality	Injury and Mortality
North Atlantic Right Whale	18	11	11	0	78	0.43	1.57
Humpback Whale	96	28	17	13	43	2.57	6.43
Other mysticetes	72	29	7	15	49	-	-
Large odontocetes	6	17	0	33	50	-	-
Small odontocetes	81	2	93	2	3	-	-

A total of 27 cetaceans were reported entangled in fishing gear by at-sea observers operating in the DFO Maritimes and DFO Quebec regions. These were mysticetes (Bowhead Whale), large odontocetes (Beluga Whale, Pilot Whale) and small odontocetes (White-sided, Risso, Common and Bottlenose Dolphins and Harbour Porpoise) (Table 3). Dolphins were the most commonly reported species, with three-quarters observed in bottom otter trawl gear. Other cetacean and gear entanglements observed were Bowhead Whale (gillnet), Pilot Whale (bottom otter trawl and pelagic longline), dolphins (bottom otter trawl, gillnet, pelagic longline and scallop drag) and Harbour Porpoise (gillnet).

Table 3. Number of events involving cetaceans and types of gear recorded by at-sea observers in DFO Maritimes and Quebec region from 2008-2014.

Species	Number Incidents	Numbers Observed in Gear			
		Otter	Gillnet	Pelagic Longline	Scallop Drag
Mysticetes	1	1	-	-	-
Large odontocetes	6	3	1	2	-
Small odontocetes	20	12	2	4	2

Sources of Uncertainty

Opportunistic sightings data are useful for recording interactions by large baleen whales and toothed whales with fishing gear. However, the commercial fisheries observed to incidentally-entangle large whales (groundfish gillnets, traps, weirs, lobster, snow crab) have little or no at-sea observer coverage (Gavaris et al. 2010). Also, large whales can drag gear and swim away before they are detected. Further, complete fishery-specific bycatch cannot be estimated from opportunistic data because the degree of reporting is dependent on the density of observers on the water and the effectiveness of advertising campaigns that direct observers to phone lines monitored by response networks. Thus, these data only provide minimum estimates of human-induced injury rates that are biased on the low side.

Fisheries-specific bycatch of small cetacean species could be estimated from at-sea observations of fishing observations. Observed injuries and mortalities would need to be scaled up to estimate entanglements caused by the entire fleet; however, the level of observer coverage is very low, especially for fixed gear (longline, gillnet). For example, observer coverage in southwest Nova Scotia and Bay of Fundy from 2007-2011 varied (percent of all fishing trips) from 2.4-10.7% in bottom otter trawl, 0-1.8% in gillnet and 1.8-5.7% in longline (Clark et al. 2015).

Currently, the cause of death is not known for more than 60% of all reported cetacean carcasses. Photographic confirmation of the species identification and injuries and undertaking necropsies of carcasses would improve the quality of sightings and the assessment of human-induced injuries. Detailed photographic evidence and necropsies has enabled NMFS to assess the seriousness of human-induced injuries and monitor the recovery of baleen whales from entangling events. Further, in absence of a program to mark gear, the human activities (e.g., aquaculture, moorings, lost gear, and specific fisheries) associated with rope entanglements cannot be assessed.

The bycatch of Harbour Porpoise reported is likely underestimated and may be substantial based on published estimates. Only a single Harbor Porpoise entanglement was reported for DFO Maritimes Region, and no observer data were available from the DFO Gulf and DFO Newfoundland and Labrador regions. Previous investigations have indicated that Harbour Porpoise are particularly vulnerable to inshore fisheries deploying fixed gillnets and traps (Read 1994). Other published estimates of Harbour Porpoise bycatch from Atlantic Canada are substantially higher than what is reported here; for example, annual catches of Harbour Porpoise in gillnet fisheries in Newfoundland and Labrador were estimated at 862-2,228 animals from 2001-2003 (Benjamins et al. 2007).

CONCLUSIONS

Opportunistic sightings and at-sea observer data are useful in providing a qualitative view of the fisheries that interact with cetaceans and those species that may be most vulnerable to a particular type of gear. The current study relies heavily on opportunistic sightings, which have no underlying sampling design and can only show a minimum and biased estimate of injury to cetaceans. Opportunistic sightings are valuable for monitoring and responding to entanglements of large whales interacting with

fisheries that have low or no observer coverage or where interactions with gear are unlikely to be observed. Also, observer coverage may not be effective for large whales that can swim away with gear attached.

Increased at-sea observer coverage is required to calculate fishery-specific bycatch rates and estimates of uncertainty. Effort-based data collection on human-induced cetacean injury and mortality should be standardized nationally and made available for analysis.

Assessment of the nature and sources of human-induced injuries to cetaceans would be improved by enhancement of the MMRP, a national program that receives annual reports of cetacean strandings and entanglements from all DFO regions. Standardizing data collection and reporting protocols among regions would aid in determining the cause and source of cetacean injuries and mortalities. Inclusion of effort based data from the regional observer programs would allow the estimation of fishery impacts on cetacean stocks throughout Atlantic Canada.

Abundance estimates for most cetacean species in Atlantic Canada are unknown, so the potential threat from fishing interactions cannot be assessed. An exception is the North Atlantic Right Whale, a species that migrates seasonally between U.S. and Canadian jurisdictions. Both DFO and NMFS have programs to monitor entanglements by this species in fishing gear. Although the estimated injury rate of 1.57 North Atlantic Right Whales per year is based on opportunistic sightings data, and is biased low, it exceeds the Potential Biological Removal (PBR) of 0.9 estimated for this species (Waring et al. 2015).

SOURCES OF INFORMATION

This Science Advisory Report is from the October 20-23, 2015, Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

Beauchamp, J., Bouchard, H., de Margerie, P., Otis, N., and Savaria, J.-Y., 2009. Recovery Strategy for the Blue Whale (*Balaenoptera musculus*), Northwest Atlantic Population, in Canada [FINAL]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. 62 p.

Benjamins, S., Lawson, J., and Stenson, G. 2007. Recent Harbour Porpoise Bycatch in Gillnet Fisheries in Newfoundland and Labrador. J. Cetacean Res. Manage. 9(3): 189-199.

Clarke, K. J., Hansen, S.C., and Gale, J. 2015. Overview of Discards from Canadian Commercial Groundfish Fisheries in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4X5Yb for 2007-2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/054. iv + 51 p.

DFO. 2010. Recovery Strategy for the Northern Bottlenose Whale, Scotian Shelf Population, in Atlantic Canadian Waters. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada. vi + 61 p.

DFO. 2012. Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*) St. Lawrence Estuary Population in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. 88 p.

DFO. 2014. Recovery Strategy for the North Atlantic Right Whale (*Eubalaena glacialis*) in Atlantic Canadian Waters [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 68 p.

Gavaris S., Clark, K.J., Hanke, A.R., Purchase, C.F., and Gale, J. 2010. Overview of Discards from Canadian Commercial Fisheries in NAFO Divisions 4V, 4W, 4X, 5Y and 5Z for 2002-2006. Can. Tech. Rep. Fish. Aquat. Sci. 2873: vi + 112 p.

Henry, A.G., Cole, T.V.N., Hall, L., Ledwell, W., Morin, D., and Reid, A. 2015. Serious Injury Determinations for Baleen Whale Stocks Along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2009-2013. Northeast Fish. Sci. Cent. Res. Doc. 15-10. 45 p.

Hooker, S.K., Baird, R.W., and Showell, M.A. 1997. Cetaceans Strandings and Bycatches in Nova Scotia, Eastern Canada. IWC Document SC/49/05. 11 p.

Read, A.J. 1994. Interactions Between Cetaceans and Gillnet and Trap Fisheries in the Northwest Atlantic. Gillnets and Cetaceans. Rep. Int. Whal. Commn. (Special Issue) 15: 133-147.

Reeves, R.R., McClellan, K., and Werner, T.B. 2013. Marine Mammal Bycatch in Gillnet and Other Entangling Net Fisheries, 1990 to 2011. Endang. Species Res. 20: 71-97.

Waring, G.T., Josephson, E., Maze-Foley, K., and Rosel, P.E., editors. 2015. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2014. NOAA Tech Memo NMFS NE 231; 361 p. doi: 10.7289/V5TQ5ZH0.

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